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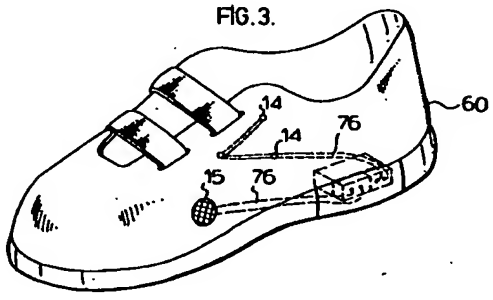
(54) **Signalling footwear.**

(57) Footwear has signal comprising light display, audible signal or both actuated by motion of the footwear causing the closing of a reed switch. The actuating means is so biased that after cessation of motion the reed switch is opened terminating the signal.

FIG.3.



EP 0 589 607 A1

This invention relates to footwear designed to give an exterior sensible signal when in use.

By exterior sensible signal is meant either (a) a visual signal created by an exteriorly visible light emitting diode (LED), light bulb or other source; or (b) an audible signal. The term sensible signal means that such signal is sensible to someone near the wearer of the footwear.

It is known to provide circuitry for installation in an article of footwear wherein the motion of the circuit while walking causes a light source to be switched on. Such a light source must be battery powered and preferably, to avoid undue battery wear and/or battery replacement, means must be provided to ensure that the light is turned off when the circuit is not in use.

In accord with this invention there is provided an article of footwear containing a series circuit comprising : a battery, at least one normally open reed switch and at least one sensible signalling means. The sensible signalling means may either be a light source visible exterior to the footwear or an audio source audible exterior to the footwear. A magnet is provided moveable between ON and OFF positions, and biassed to the OFF position. In the ON position the magnet is located to close the reed switch and in the OFF position to open it. The magnet is preferably biassed to an OFF position to save undue battery wear. When the reed switch is closed the sensible signal is activated, when the reed switch is open, it is not.

A particular advantage of reed switches over other switches is that they may be remotely actuated. Thus the reed switch and connected circuitry may be located in a control module while the actuator for the switch may be outside the module.

There may be a plurality of reed switches, each individually corresponding to an ON position, thus there may be more than one signalling means, each one activated by one of the reed switches. Alternatively multiple signalling means may be operated by a single reed switch. Although one reed switch may be open when another is closed there must be an OFF position where all signalling means are extinguished and the magnet should be biassed to this OFF position in order to save battery power.

In one preferred aspect of the invention, the signalling means is a light source (preferably an LED) and in an alternate aspect the signalling means is a sound source.

Whether the light or sound source is used the magnet mount must allow the magnet to move between one or more ON positions, on the one hand, and an OFF position, on the other hand, and preferably be biassed toward the OFF position.

It will be noted that if other means of extinguishing the signal means is provided, the bias of the magnet to OFF position is not as important.

In one preferred aspect of the invention the magnet is allowed to move in a locus of movement including the OFF position and at least one ON position.

In a preferred variant of the form of the invention in the previous paragraph the magnet is inertially moveable along a bore over a locus including an OFF position and at least one ON position and is spring biassed to OFF position.

In an alternative to the variant of the previous paragraph, the magnet is inertially moveable along a bore over a locus involving an OFF position and at least one ON position and is magnetically biassed to OFF position.

With either the spring or magnetic biasing described above, two springs or two magnets may be used to bias the switching magnet to a central OFF position between two ON positions adjacent opposite ends of the locus of movement.

In a further alternative of the invention the magnet may be spring or magnet biassed toward OFF position and the magnet may be shaped to ride as a floating piston in a bore which acts like a piston cylinder. Bladders in the shoe containing gas or liquid may be located at one or both ends of the bore to be compressed and expanded by the normal flexures of walking to move the magnet between an OFF position and one or two ON positions.

In the drawings :

Figure 1 is a perspective view of a shoe showing both visible and audible signalling means,

Figure 2 is a schematic top view of Figure 1, showing the disposition of the signalling means,

Figure 3 is a perspective view of a shoe showing both visible and audible signalling means in an alternate disposition to that of Figure 1,

Figure 4 is a schematic top view of the shoe of Figure 3, showing the disposition of the signalling means,

Figure 5 is a schematic perspective view of the signalling and control modules associated with the arrangement of Figure 1,

Figure 6 is a schematic wiring diagram of the control module of Figure 5,

Figure 7 is a schematic wiring diagram of the light module of Figure 5,

Figure 8 is a schematic wiring diagram of the sound module of Figure 5,

Figure 9 is a schematic view of the operation of a movable magnet and reed switch to determine the operation of a light emitting diode (LED),

Figure 10 is a schematic view of the operation of a movable magnet and reed switch to determine the operation of a sound synthesizer,

Figure 11 schematically demonstrates the action of a linearly movable spring biased magnet, on a reed switch,

Figure 11A shows an alternative construction to Figure 11,

Figure 12 schematically demonstrates the action of a linearly movable magnetically biased magnet

on a reed switch,

Figure 12A shows an alternative construction of Figure 12,

Figure 13 is a perspective schematic view of a magnet and reed switch,

Figure 14 in section, and Figure 15, in perspective illustrate the use of an air driven magnet with a reed switch,

Figure 14A shows an alternative construction to Figure 14.

Figure 16 shows a rotary driven magnet for use in controlling a reed switch,

Figure 17 schematically indicates the heel of a shoe with a linearly slidable magnet therein,

Figure 18 schematically indicates the heel of a shoe with an air driven magnet and a single air bladder,

Figure 19 schematically indicates the heel and sole of a shoe with an air driven magnet and double air bladders,

Figure 20 schematically indicates the heel of a shoe with a rotatably mounted magnet therein,

Figure 21 is a side view of the heel of Figure 18 with the single bladder therein,

Figure 22 is a side view of the sole and heel of a shoe with the double bladder of Figure 19.

Although the examples show shoes emitting both visible and audible indications, shoes in accord with the invention, will frequently be designed to provide only light, or only sound signals.

An 'Actuator' herein is the component designed to control the state of the reed switch. Various actuators are shown in Figures 9-22 inclusive.

Figure 9 shows the basic circuitry for a control module using LED's having battery 10 connected in series with one or more normally open reed switches 12 (which are themselves connected in parallel) and one or more LED's 14 (shown in Figure 7). The LED's are shown connected across terminals at jack elements A,B to illustrate that the LED's may, if desired, be part of a separate plug-in module (see also Figure 5) for the circuit. Movemen of magnet 16 aligned as shown, into proximity to a reed switch closes the reed switch while movement of magnet 16 out of the immediate proximity of the reed switch causes it to assume its naturally open state. Thus in either ON position of the magnet 16 one of the reed switches 12 will be closed and the LED's will be on. In the OFF position both reed switches will be open and the LED's will be OFF.

Figure 10 demonstrates the analogous circuit using a sound synthesizer 72 (See Figure 8). The sound synthesizer has terminals C,D. (The sound synthesizer may use any suitable synthesizer integrated circuit ('IC' or 'chip' 18 but I prefer to use MC 68HC05K0 manufactured by Motorola). As shown in Figure 10 the battery 10 is connected through one or more the reed switch(es) 12 connected in parallel. The connections may be made through jack elements at C,D if a plug-in module (see Figure 5) is used. The magnet 16 is shown in the neutral or OFF position at which time all reed switches will be open. When under motion of or flexure of the shoe, depending on design criteria to be described hereafter, the magnet moves into an ON position in proximity to a reed switch, the corresponding reed switch will close and the closure of either reed switch connects the battery across the C,D terminals activating the sound synthesizer. The synthesizer may be programmed to make a variety of sounds at the choice of the programmer, for example 'choo' for a children's shoe.

Figure 11 schematically illustrates an actuator comprising a capsule 22 for embedment in a shoe containing a cylindrical magnet 24, which in this instance may be in either polarity. The magnet 24 is biassed toward a central or OFF position by opposed compression springs 26. Reed switches 12 for a circuit such as Figures 9 or 10 are located adjacent each end of the capsule 22 to be activated when the magnet moves toward such-end (an ON position), Thus under the motion of walking or running the magnet 16 moves intermittently toward one of the ends and actuates the proximate reed switch 12, to light the LED's 14 (Figure 7) or activate the sound synthesizer 18, Figure 8. When the motion of the shoes stops, the springs 26 move the magnet to OFF position turning off the visible or audiable signal. If desired one reed switch 12 only may be used and only one spring 26 located to bias the spring toward an OFF position at the end of capsule 22 remote from the reed switch. In the actuator of Figure 11, and its one spring alternative, the spring must be yielding enough to permit magnet travel to the ON position during walking.

Figure 11A shows an alternative construction wherein capsule 22 containing a single spring 26 biases the magnet 24 out of proximity to the single reed switch 12. Under the inertial forces of walking the magnet 24 may move leftward in tube 22 sufficiently to close the single reed switch 12 actuating a sound or light circuit, or both, during the interval ending when the spring 26 moves the magnet 24 out of effective proximity to reed switch 12.

Figure 12 shows a capsule 22A with a magnet 24 therein fixed in position at the end of capsule 22A biassed to the central OFF position by the bias magnets 30 and 32. Under the motion of walking or running the inertia of the magnet 24 will cause it to slide toward one end or the other of the capsule against a bias to reach an ON position and activate a reed switch 12 to cause the audible or visual signal as in the circuits of Figure 9 or 10.

Figure 12A shows an alternative construction wherein capsule 28 is associated with a single magnet 30 which biases magnet 24 out of proximity to the single reed switch 12. Under the inertial forces of walking the magnet 24 may move leftward in tube 22

sufficiently to close the single reed switch 12 actuating a sound or light circuit, or both, during the interval ending when the repulsion by the magnet 30 moves the magnet out of effective proximity to reed switch 12.

Figure 13 is a schematic indication of an actuator capsule 22 or 22A (omitting the springs or bias magnets) a magnet 24 and a reed switch 12.

In Figures 14 and 15 a pair of bladders 34 is shown connected to a bore in cylinder 36 wherein a magnet 24 is shaped to act like a piston in a piston cylinder. Springs 38 bear on stops 40. In Figure 14 the leftward or rightward movement of the magnet 24 is limited by bias springs 38 and the magnet 24. When the shoe is not flexed to compress one of the bladders 34 the springs drive the magnet 24 to a central location, that is to the OFF position away from either reed switch 12. Under the flexure of motion each bladder 34 volume is intermittently compressed and the air (or liquid) contents of the bladder move che magnet rightward or leftward to the ON position to close the reed switch and activate a visible or audible signal in accord with the circuitry of Figures 9 or 10. As an alternative to the spring biassing in the alternative of Figures 14 and 15, magnetic biassing by analogy to Figure 12 may be used. A single bladder and reed switch may be used. Similarly, as an alternative to the arrangement of Figure 11, excursions of the magnet 24 may only be allowed in one direction and a single reed switch used.

Figure 14A (see also Figure 21) shows an alternative construction where cylinder 36 is connected to a single bladder 34 and, opposite the bladder, contains a single spring 38 biasing the magnet 24 out of effective proximity to the single reed switch 12. Under pressure from bladder 34 the magnet 24 may move leftward in cylinder 36 sufficiently to close the single reed switch 12 activating a sound or light circuit, or both, during the interval ending when spring 38 moves the magnet out of effective proximity to reed switch 12.

Figures 16 and 20 show an alternative means for controlling the reed switch. The magnet 24P is pivotally mounted like a flywheel with polarity as shown. Stationary bias magnets 52 and 54 are both designed to be polarized south toward the locus of magnet 24P with the rotating magnet polarity as shown. When the shoe is stationary, the north pole of rotatable magnet 24P is held over one of the stationary magnets and the rotating magnet is kept in or of two OFF positions remote from either reed switches 12, so that these are open and the circuit of either Figure 1 or Figure 2 is inactive. When the shoe 18 moving the magnet 24P rotates or oscillates through an arc, from time to time closing a reed switch 12 and actuating the circuit of Figure 9 or 10 to produce the audible or visual signal.

When the motion of the shoe stops, the rotating magnet 24P will come to rest in one of the OFF positions allowing the reed switch to open terminating the light and/or sound signal.

Instead of allowing the magnet 24P to travel through 360°, it may be constrained to oscillate through a small arc between an ON position and an OFF position, the latter determined by a magnet such as 54.

Figures 1-4 show a running shoe 60 with a cavity in the heel containing the control module 64 a light module 70 and sound module 72. The light module and the sound module may be used together or as alternates. Figure 5 shows the control module having female connections for jack connections A,B,C and D, corresponding to those shown in Figures 6-10 and adapted to receive either the light module or the sound module or both. These may be plugged directly into the control module, as shown to be located in the heel, as indicated by Figures 1 and 2 or the light and sound output devices (LED's 14 or speaker 15) may be remotely located and connected by appropriate leads 76 as illustrated in Figures 3 and 4. Although such leads 76 may be wires moulded into the shoe I would prefer to use CAPTOR (TM) film circuitry a thin plastic film with the conductor 76 printed on it produced by Dupont Chemical Co. and sold under the trade mark PYRALUX.

In Figures 17-20 the actuator tube is located near the control module 64 with the reed switch inside module 64 and this is suitable for the inertial and spinning magnet application of Figures 9-14, and 16. However, the bladder operated actuator for the actuation of the device in Figures 14 and 15 must, as shown in Figures 14 and 15 be located in the soles or heels of the shoe as shown in Figures 18 and 19. Figure 19 shows a double bladder 34 design as shown in Figures 14 and 15 and the physical disposition of the bladders 34 is indicated in Figure 22. Figure 18 shows a single bladder design, discussed previously and Figure 21 shows its disposition in the heel of a shoe.

The operation of the control module 64 of Figure 6 will be obvious. Responsive to movement of a permanent magnet 16 or 24 (not shown in Figure 6) into suitable proximity to reed switch 12, the latter will close, connecting battery power across terminals A and B on the one hand and across terminals C and D on the other hand. In connection with the light module 70 it is obvious that the LED's will light as soon as power is connected across terminals A and B. In connection with module 72,sound synthesizer integrated circuit ('IC' or 'chip' 18 is, as stated,preferably that manufactured by Motorola under number MC68HC05K0. The positive lead from terminal D is connected to the positive terminal P of IC 18 and the negative lead is connected to negative IC terminal N. When power is applied across terminals P and N a modulated output from terminal M is applied to the base of transistor amplifier 73. (For the transistor amplifier I prefer to use model 9012). The amplified out-

put is applied to the speaker 15 to produce the sound. The synthesizer will give a choice of sounds including a sound similar to the sound 'choo' for children's shoes. The resistance 75 is connected in parallel with the speaker 15 and typically has the value 303 KΩ. Other sound synthesizers with their own characteristic connections are within the scope of the invention. Thus any shoe may have a light module alone, a sound module alone or both. On closure of the reed switcn due to movement of the magnet during walking, the connected module is activated and light sound or both are produced until the reed switch is opened.

Claims

1. An article of footwear containing:

   a circuit comprising, at least one normally open reed switch in series with a battery and signalling means,

   said signalling means being adapted, on receipt of battery power, to emit a signal evident exteriorly of said shoe,

   a permanent magnet mounted in said shoe to be moveable when worn during walking motion between at least one ON position where said magnet closes a reed switch in said at least one circuit and at least one OFF position where said magnet allows all said reed switches to open.

2. An article as claimed in claim 1 wherein said signalling means comprises at least one LED which is illuminated when said magnet is in an ON position.

3. An article as claimed in claim 1 wherein said signalling means comprises an audible sound source which is activated when said magnet is in an ON position.

4. An article of footwear as claimed in claim 1 wherein said magnet is biassed to OFF position and mounted to move to said at least one ON position during walking motion.

5. An article of footwear as claimed in claim 4 wherein said magnet is inertially moveable within a bore and spring biassed to OFF position and moveable onto ON position during walking motion.

6. An article of footwear as claimed in claim 4 wherein said magnet is swingably mounted to move through a locus of movement including ON and OFF positions.

7. An article of footwear as claimed in claim 4 wherein said article defined abladder opening into a cylindrical bore, said magnet is shaped to act as a piston slidable in said bore, means adapted to bias said magnet toward said bladder, said air chamber is designed to alternately expand and contract under walking motion,

   said magnet under the influence of said biassing means and bladder pressure being adapted to assume OFF position when said footwear is at rest and to pass through an ON position when said footwear is flexed by walking.

8. An article of footwear as claimed in claim 1 wherein said circuit includes a pair of reed switches connected in parallel and collectively in series with said battery and signalling means, each reed switch corresponding to an ON position of said magnet,

   and wherein the locus of said magnet during walking action includes an ON position for each reed switch and the OFF position.

9. An article of footwear having a magnet located therein,

   said magnet being adapted to move, during motion of said shoe between at least one ON position and at least one OFF position,

   circuit means including a reed switch located in said shoe,

   said reed switch being adapted to be closed and open in ON and OFF positions respectively,

   said circuit being adapted responsive to the closed state of said reed switch to produce a sensible signal exterior to said shoe.

10. An article of footwear as claimed in claim 9 wherein said sensible signal is a light signal.

11. An article of footwear as claimed in claim 9 wherein said sensible signals an audible signal.

12. An article of footwear as claimed in claim 9 wherein said magnet is biassed to OFF position and mounted to move to said at least one ON position during walking motion.

13. An article of footwear as claimed in claim 12 wherein said magnet is inertially moveable within a bore and biassed to OFF position and moveable onto ON position during walking motion.

14. An article of footwear as claimed in claim 12 wherein said magnet is swingably mounted to move through a locus of movement including ON and OFF positions.

15. An article of footwear as claimed in claim 12

wherein said article defines a bladder opening into a cylindrical bore, said magnet is shaped to act as a piston slidable in said bore, a means biassing said magnet toward said chamber, and said bladder is designed to expand and contract under walking motion,

said magnet under the influence of said biassing means and bladder pressure being adapted to assume OFF position when said footwear is at rest and to pass through an ON position when said footwear is flexed by walking.

16. An article of footwear as claimed in claim 9 wherein said circuit includes a pair of reed switches connected in parallel and collectively in series with said battery and signalling means, each reed switch corresponding to an ON position of said magnet,

and wherein the locus of said magnet during walking action includes an ON position for each reed switch and the OFF position.

FIG.1.

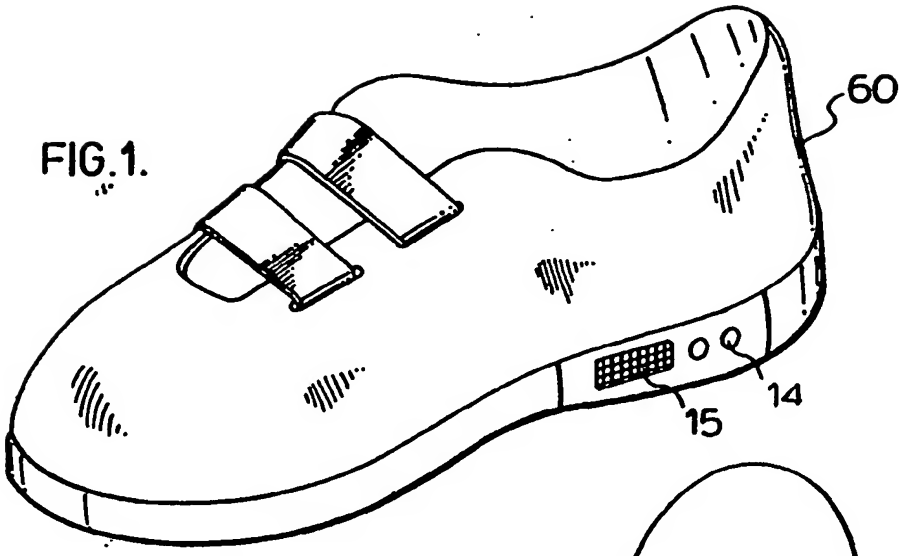


FIG.2.

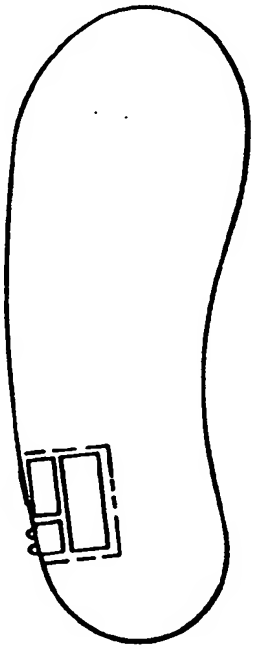


FIG.4.

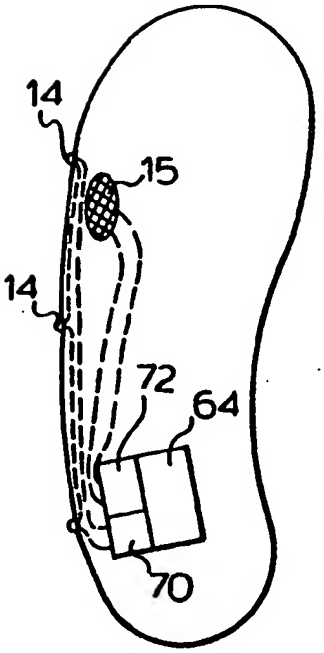


FIG.3.

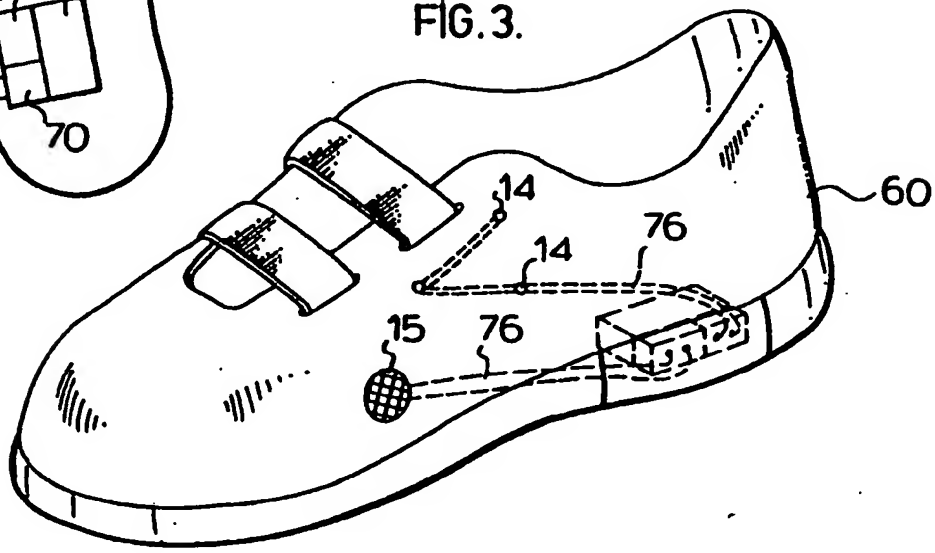


FIG.5.

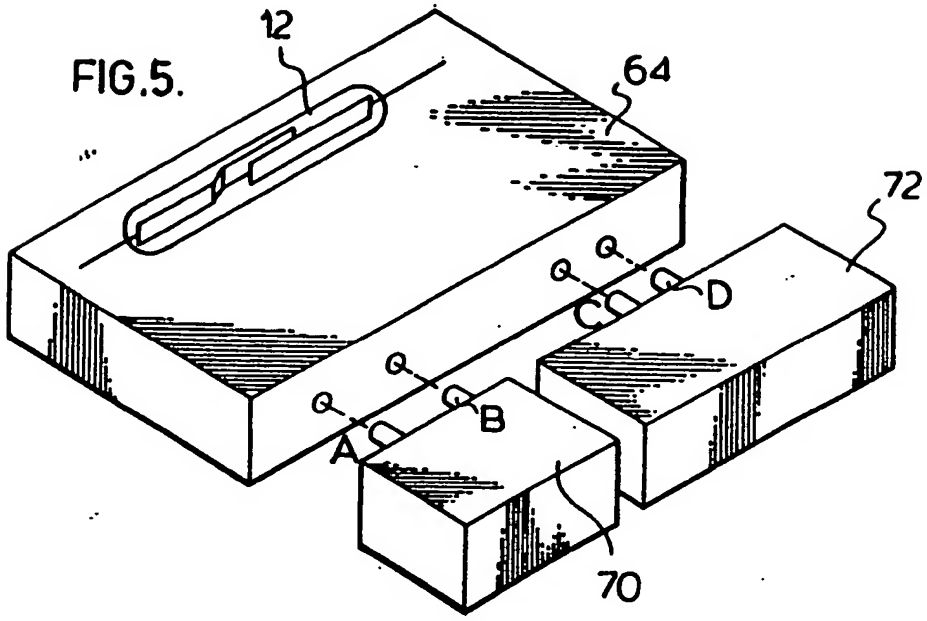
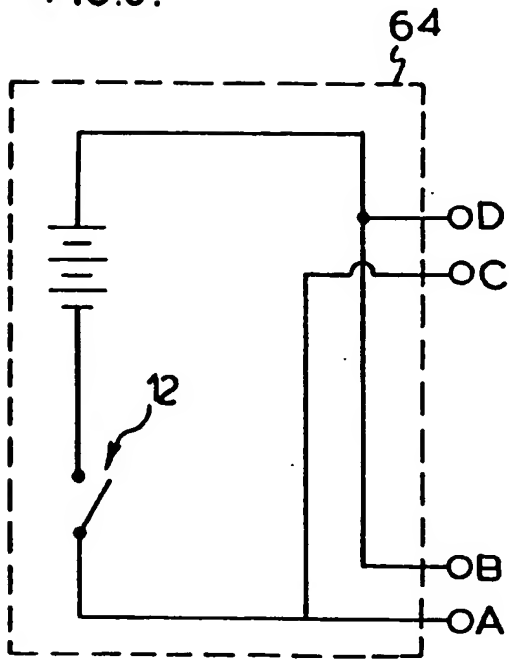
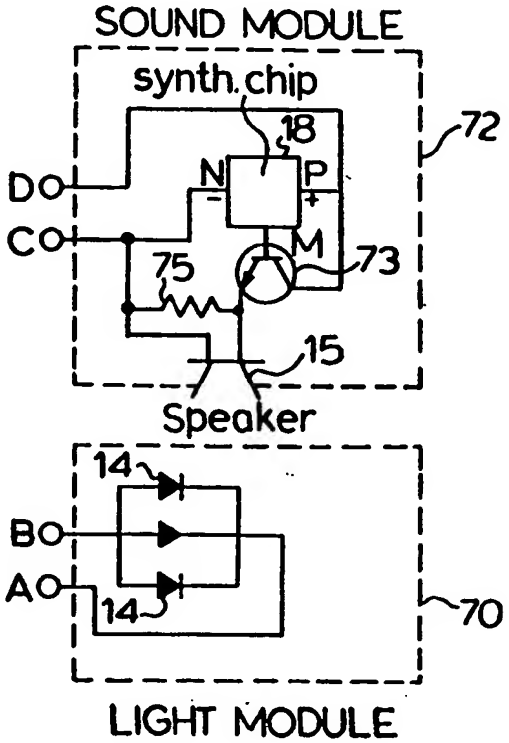


FIG.6.



CONTROL MODULE

FIG.8



LIGHT MODULE

FIG.7.

FIG.9.

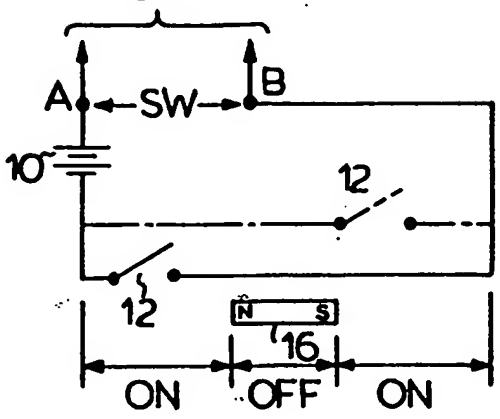

To light module
Figure 7
A
SW
B
10
12
12
N
S
16
ON
OFF
ON

FIG.10.

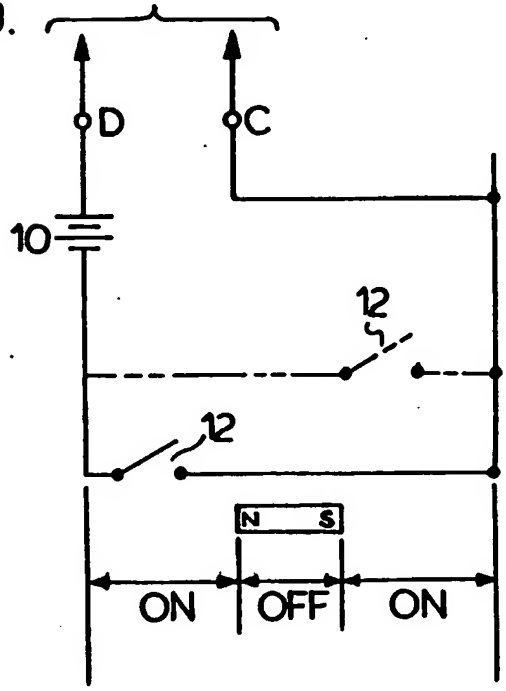

To sound module
Figure 8
D
C
10
12
12
N
S
ON
OFF
ON

FIG.11.

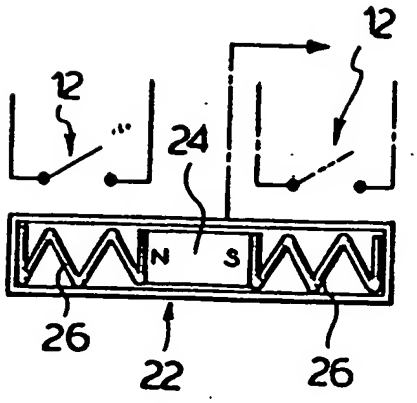


FIG.11A.

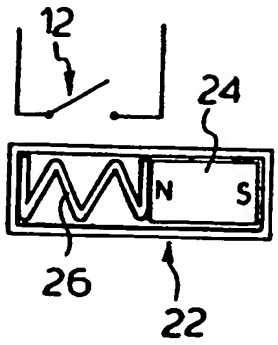


FIG.12.

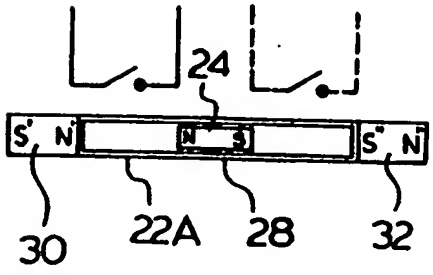


FIG.12A.

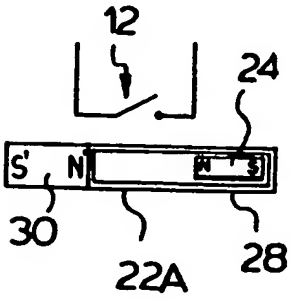


FIG.14A.

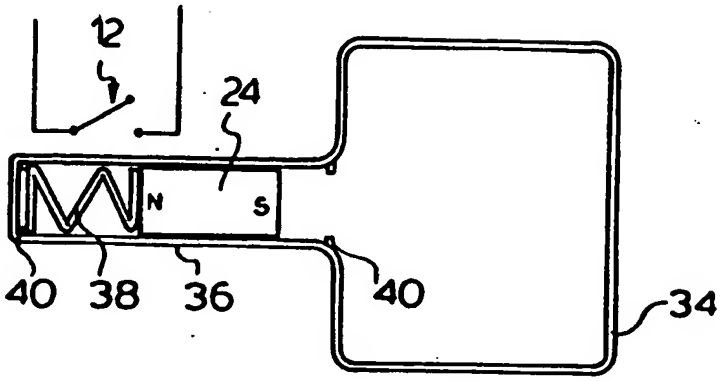


FIG.13.

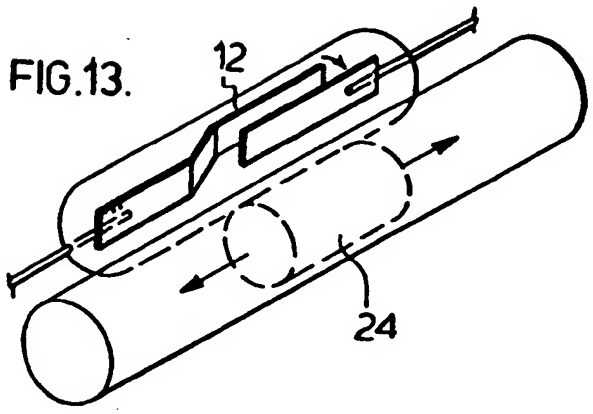


FIG.14.

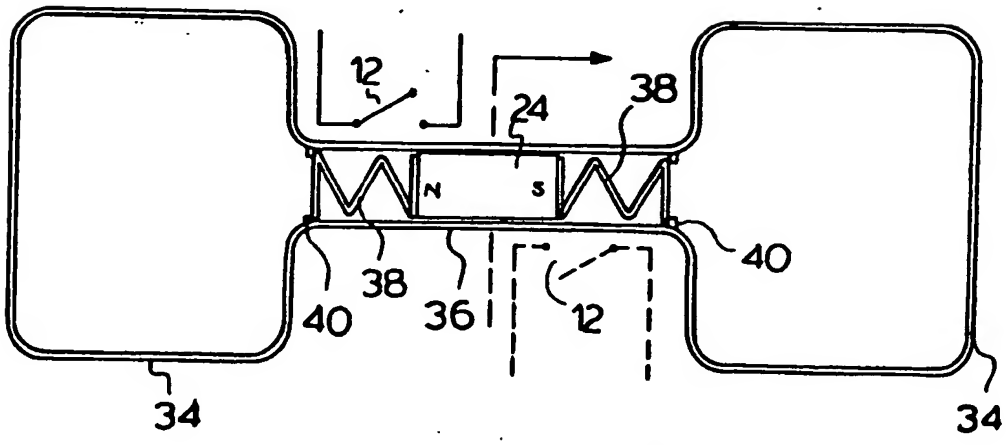
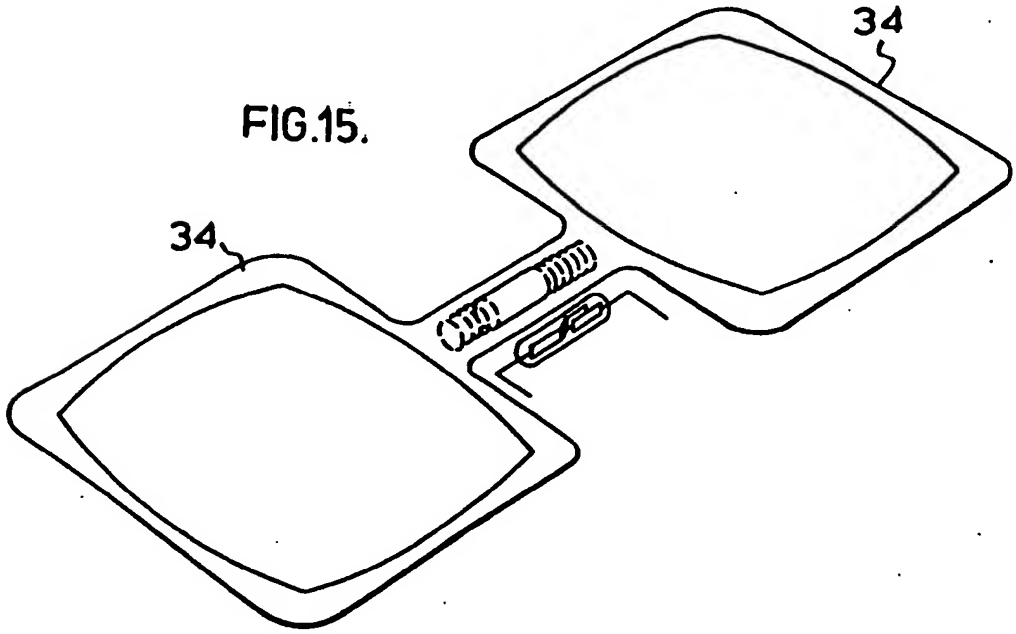


FIG.15.



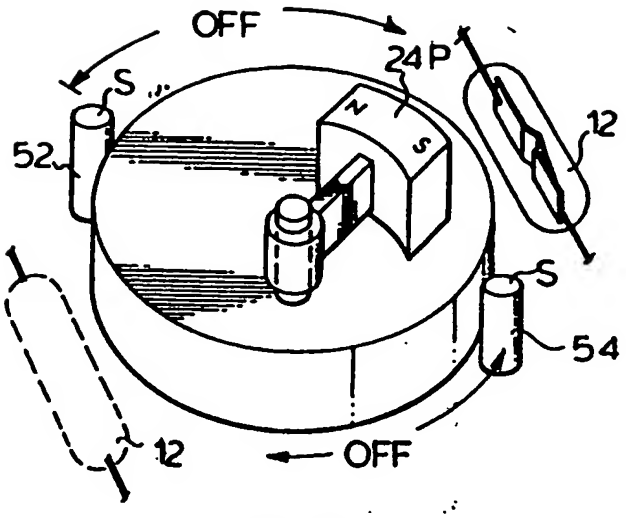


FIG.16.

FIG.17.

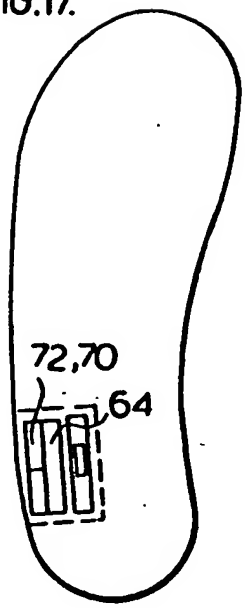


FIG.18.

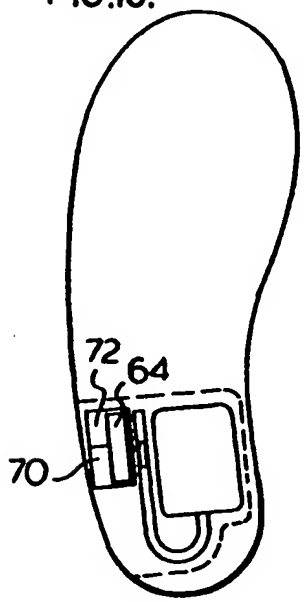


FIG.19.

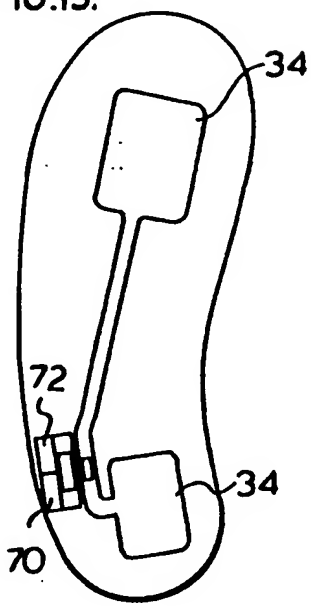


FIG.20.

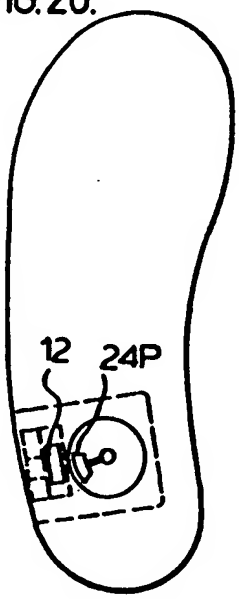


FIG.21.

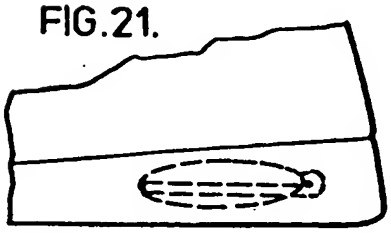
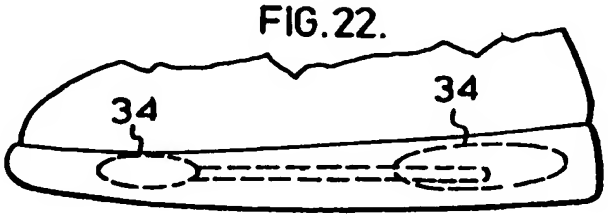


FIG.22.



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EUROPEAN SEARCH REPORT

Application Number
EP 93 30 7237

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
X	US-A-4 350 853 (GANYARD) * the whole document *	1-5,9-13	A43B3/00
A	CA-A-1 193 436 (ZIEMLINSKI ET AL) * the whole document *	1-3,9-11	
A	US-A-4 848 009 (RODGERS) * the whole document *	1-16	
A	US-A-2 572 760 (RIKELMAN) * column 3, line 46 - column 4, line 2; figures 7-8 *		
A	GB-A-2 089 015 (TANG CHUEN) * page 2, line 1, paragraph 1 -paragraph 2; figures 1,3 *	1,9,10	
A	WO-A-91 18374 (DAKIN ET AL) * page 3, last paragraph - page 4, paragraph 2 *		
			TECHNICAL FIELDS SEARCHED (Int.Cl.5) A43B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	17 December 1993	Pipping, L

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